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THE WATERWAYS OF GERMANY

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IT has been customary of late to look to Germany for examples of progress in many lines of endeavor. Germany's schools, Germany's army, Germany's commercial methods, and many other German institutions and ideas have been studied and copied by the progressive nations of the world. Among other things we have directed out attention to the improved waterways.

Germany is well supplied with natural waterways. In the Memel, Pregel, Vistula, Oder, Elbe, Weser, Ems, Rhine, and Danube rivers, nine independent systems may be distinguished. The Pregel, Weser, and Ems, and most of the Oder belong to the German Empire. The Danube has its source in Germany, but four-fifths of its course lies outside. It is navigable to Ulm, two hundred and twenty miles above Passau, and four of its tributaries are also navigable. The 470 miles of the Rhine which belong to Germany are navigable for all this distance, and six of its tributaries are navigable for considerable distances. The Ems is connected with a widely branching system of canals. The Fulda, navigable for sixty-three miles, and the Werra, form by their juncture the Weser, which has a course of 271 miles. Ocean-going steamers cannot, however, reach Bremen and so unload at Bremerhaven. The Elbe enters German territory at Bodenbach, 490 miles from its mouth. It is navigable above this point through its tributary, the Moldau, to Prague. Hamburg may be reached by vessels of seventeen feet draught. The Elbe and the Oder have important navigable tributaries. On the Pregel, ships of three thousand tons reach Konigsberg, and river barges reach Insterburg, and the Memel is navigable for 113 miles.

Thus it may be seen that Germany abounds in natural waterways. They were, however, in their natural state, far from ideal as a means of transportation. Many of the streams were soft of bank and shallow of channel. Now many of them shrink, during the dry months, to a point that would be considered impossible for navigation in this country. Yet these same streams carry millions of tons of freight annually. But the present enviable condition of the German waterways is due to something besides an abundance of navigable streams. It is due to a modern, comprehensive and consistent policy which aims to keep the German waterways at their highest possible point of utility. ***It is in the efficient and intelligent application of this policy that Germany has achieved her great success.***

Even in the Middle Ages the foreign trade of Germany relied chiefly on waterways, and the Rhine was for over a thousand years a highway of trade between the Orient and Great Britain. The prosperity of early German towns was founded on cheap water transport.

The big rivers of Germany, however,were until a recent period, in a state of neglect, with soft banks that kept the channels filled with silt, and with shallow beds that were bared in dry seasons. But when Germany felt the spur of commercial competition, all antecedents pointed to the development of the waterways as the salvation of her growing manufactures. Soft banks were replaced with masonry walls. Rocks were blasted out of river courses, and provisions were made against ice forming in the winter months. Well equipped harbors and quays were built at towns within reach of inland navigation. During the period from 1871-1900, Germany built 1091 kilometers of inland canals, improved all her navigable rivers, and the German-Austrian canals, proposed or begun, will have a length of 3,657 kilometers and an estimated cost of $250,000,000. Five million dollars a year has been expended during the last twenty years on the regulation of the Rhine, until Cologne, 150 miles inland, has become a seaport, and 600 ton boats may go to Strassburg, 300 miles inland. Without doubt this river is now the most perfect river in the world for the promotion of industry.

This development is not confined to the greater rivers such as the Rhine. The tributary streams have been improved. The Main, for instance, has been deepened from 2 3-4 feet to 8 1-4 feet for twenty miles to Frankfort, at a cost of $2,000,000.

The fact that the Rhine has its mouth in another country has long been a source of dissatisfaction to Germany. One of the most conspicuous examples of the confidence which Germany places in her waterway policy is the Dortmund-Ems canal, built to give a German outlet to the Rhine. It was commenced in 1899, is 168 miles long, 8 1-4 feet deep, and ships of 1,000 tons can use it. The total cost was about $20,000,000, or $125,000 per mile. Germany stands firmly for providing an alternative cheap transport system, which will bring with it wholesome competition, and with this end in mind, keeps on extending, enlarging, and improving her natural and artificial waterways year by year.

Although France has a greater length of waterways than Germany, the latter country sends over its rivers and canals a vastly greater amount of traffic. It is in the utilization if her waterways, that Germany stands supreme. In other words Germany utilizes most effectively, and has developed most highly, the three elements of inland water traffic, namely (1) safe channels, (2) cheap and efficient river ports, and (3) cheap, safe, and efficient carriers. Let us glance for a moment at the ports. At the mention of German river ports one immediately thinks of Hamburg. This is truly a model port. Thirty million dollars have been spent to make it adequate for the enormous river

and ocean traffic which meet at this point. There are slips for hundreds of river barges, whose cargoes are lifted into waiting ships or into warehouses, in every case by the most modern machinery.

Instead of attempting a description of the complex workings of this great port, it may be better to consider the miniature Hamburgs, the river havens of Germany. Every town situated on any navigable channel has its haven, villages of 2,000 inhabitants not being excepted. This haven is invariably a well equipped transfer point. There is a dredged basin, with a vertical quay wall within. Along the quay is a warehouse (public), and between the warehouse and the water runs a railroad track. Cranes and hoists, also public, provide the means of cheap and rapid transfer of freight, and the railroads, sometimes under compulsion, are forced to provide cars for trans-shipment. As in other affairs *Grundheit* is the watchword of the German waterways.

If we were to contrast the waterways and the ports of Germany with those of our own country, our national pride would suffer a severe jolt. The difference between the carriers of the two countries is no less marked. In the first place, German freight and passenger traffice on the waterways are divorced. The passenger boats are of light draft, fairly fast, and completely modern. The German freight traffic is carried for the most part in barges of light draft and large carrying capacity. These barges average about 400 tons burden, and 2,300-ton boats are not uncommon on the Rhine. All barges have their holds so constructed as to be readily accessible, and all heavy freight is handled by machinery. The cost of transportation is cheapened by the use of special towboats which draw 5,000 tons of cargo in barges upstream at a fair speed. These towboats are of several types, but all have feathering wheels to prevent pounding, and all combine a maximum of power with a minimum of draught. German waterways are free to all alike, and this competition insures cheapness and efficiency on the part of the carriers. The tendency in German inland water traffic has been steadily towards an increase in the size of the carriers with a corresponding decrease in the cost per ton-mile.

The actual traffic on the waterways not only has increased tremendously, but at a greater rate than the railroad traffic for the same time. The tons of freight *per kilometer* have increased three and one half times as rapidly as railway carriage.

The theory of transportation upon which Germany based her confidence is apparently simple and conclusive. Four to six times the energy is required to haul goods by rail, and from thirty to sixty times the energy by road that is required by water. Canals are cheaper to build, and cheaper to maintain. Lastly, more traffic can be handled on a canal than by rail or road. Strangely enough, Germany is one of the few countries of the world which has made practice bear out theory, and it is the only great country which is carrying this

policy to its logical conclusion. Just how clearly the Germans understand their problem, and how comprehensive their policy toward it is can be seen from the following quotation from a Germany official paper.

"Any means whereby the distances which separate the economic centers of the country may be diminished must be welcomed and considered as progress, for it increases our strength in our industrial competition with foreign countries. * * * Hence, the aim of a healthy transport policy should be to diminish as far as possible the economically unproductive cost of transportation. A country such as Germany, * * * occupies the most favorable position, if, owing to cheap inland transportation, its economic centers are placed as near as possible to one another. When this has been achieved, Germany will be able to dispense with many foreign products, and it will occupy a position of superiority in comparison with those states which do not possess similarly perfect means of transport."

Cheap water transportation enables Germany's inland manufacturers to place their goods upon foreign markets more cheaply in many instances than those of competitors who manufacture on tide water. They give life to some thriving industries which would perish if the freight rate were raised $.004 per ton-mile. And at the same time that they make it possible for German manufacturers to compete in foreign markets, they furnish a means of bringing foreign grain cheaply into the country to feed an essentially industrial population.

This has been Germany's achievement: she has seen a need clearly, and has conceived a policy to meet that need.

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Mr. Ford A. Carpenter has prepared a little book of 118 pages on the "Climate and Weather of San Diego, California." It is published by the chamber of commerce of that city, which leads one to expect the booster type of treatment. The author, however, is the local forecaster of the U. S. Weather Bureau and the book throws a good deal of light on the peculiarities of the climate of the extreme southern coast of California.

A STUDY IN HISTORICO-GEOGRAPHY—THE ESTABLISHING OF THE OHIO-MICHIGAN BOUNDARY LINE

By CONSTANCE GRACE EIRICH

HERDER tells us that history is geography set into motion; Miss Semple says: "Today a fact of geography becomes tomorrow a factor of history." Several facts of geography are fundamental in the dispute between Ohio and Michigan over the boundary question. In origin, this long and bitter quarrel resembled the state and colonial contentions over boundaries, all of which arose from either ignorance of local geography, or an unpardonable disregard of vested rights. Michigan claimed her boundary as a vested right from the Ordinance of 1787; whereas Ohio urged that the Ordinance based its determination on erroneous geographical facts, hence the boundaries as laid down in it should not be strictly binding†.

The geographic factors involved in the question are:

1. The true location of the southern end of Lake Michigan.
2. The physiography, coast line and harbors of the western part of the Erie basin.
3. The prospective canals of Ohio.
4. Population, i. e., relative size of the two groups concerned.

Southern End of Lake Michigan.—In the Ordinance of 1787, Congress reserved the right to form one or two states in that part of the North West Territory which lay north of an east-west line drawn through the southern bend or extreme of Lake Michigan. This line would form the southern boundary of the states to be created later.

The trouble arose because due care was not exercised in determining the line. Maps of the Western country extant at the time the Ordinance was adopted show the south end of Lake Michigan to be so far north of its true position that the northern boundary of the territory of Ohio was laid down at nearly the 42nd parallel, being indicated on the map by a pencil line drawn from the southern bend of the lake to the Canadian line, intersecting Lake Erie between the River Raisin and the town of Detroit. No further thought was given this indefinite boundary until Ohio moved to become a state. Ohio's Constitutional Convention, which convened at Chillicothe in 1802, was proceeding on the assumption that the old maps were correct, and that the line as defined in the Ordinance would terminate at some point north of Maumee Bay. While the subject was under discussion, a man, formerly a hunter in the Lake Michigan country, mentioned the fact that the lake extended much farther south than was generally supposed. This possibility immediately alarmed the

*This paper was prepared in connection with a course in geography at the University of Michigan, under the direction of Professor Frank Carney.

† Tuttle, Charles R., *General History of Michigan*, 1873, p. 450.

members of the convention, who in order to provide against the contingency that the line, mentioned in the Ordinance, might be further south than was commonly supposed, inserted in their constitution the famous "proviso" to the effect, that if the southern bend of Lake Michigan should extend so far south that a line drawn due east from it should not intercept Lake Erie, or if it should intersect the lake east of the mouth of the Maumee River, then, with the assent of Congress, the northern boundary should be established by and extend to, a line running from the southern end of Lake Michigan to the most northely extreme of Maumee Bay.* Ohio's Constitution was accepted by Congress, though no special mention was given to the proviso. Owing to the fact, however, that the Constitution was accepted by Congress, many Ohio people took it for granted that Congress had recognized the proviso, and that the line was thus legally fixed. The boundary dispute therefore had its genesis in an incorrect map.

Area in Dispute.—Population in this area was so sparse that the boundary line question was dormant till the expanding industries of the more thickly settled parts of Ohio demanded transportation outlets, and the state began to discuss canals. Lake ports and their hinterlands at once became regions worth serious consideration. Michigan held to the line as literally laid down in the Ordinance, since it gave her the harbor of Maumee with a strip of land five miles wide on the west and eight miles wide on the east. Naturally, Ohio urged the boundary of her proviso which placed these advantages in her domain. The limits which Michigan proposed would have made her a larger state than Ohio, and one of the largest in the Union at that time; Ohio would then be one of the smallest of the western states. Furthermore, Michigan would have a longer coast line than any other state of its size and Ohio, being on one of the smallest of the Great Lakes, would have very little coast line. Hence it seemed equitable to give Ohio all the coast line that was possible even at the expense of Michigan. If Michigan did lose Maumee Bay she still had a good harbor on Lake Erie. At that time, Ohio was considered the key to the west because of her location between the new and the old country, and her accessibility to old centers of settlement; hence, the commercial interests of Ohio, as well as of the country at large, demanded that Ohio should have as many lake ports as possible.

Prospective Canals.—Associated with the Maumee harbor is perhaps the most important factor in the boundary dispute—the influence of the canals. The Erie Canal, completed in 1825, stimulated the western states to open up their interiors by canals, that they might profit through this waterway to the East. The stimulus was first felt by Ohio because of nearness to the western terminus of the Erie Canal. The long lake frontier on the north, the narrow width between Lake Erie and the navigable Ohio on the south and east, and the interior rivers, suggested the feasibility and advantages of an extensive

*Cooley, Thomas M., *Michigan*, 1905, pp. 216-217.

system of artificial waterways. At this time, too, steamboats were operating on the lakes and rivers, greatly enhancing the value of Maumee Bay as well as developing the full usefulness of the interior waterways, both as avenues of immigration and means of trade.

The next influence bearing on the boundary question was the Miami-Erie Canal which was to connect the Ohio River at Cincinnati with Lake Erie. This canal was contemplated about 1825 and begun in 1830, though not completed until 1845, almost eight years after the boundary was fixed; that is, in 1837, the year Michigan was admitted as a state. It was the anticipated advantages of the canal which affected the boundary question. The Wabash-Erie Canal was surveyed in 1836 and completed about 1845; the agitation which resulted in this canal was an important factor in the boundary dispute. The canal propoganda was supported by Ohio capitalists and by those interested in Ohio, but living in the East, a group of whom had undertaken to build a city at Toledo, and others had interests in other towns of the disputed territory. These men were actively interested in Ohio's contention over the boundary; they foresaw that canals would be a means of opening up a large central area of farms which formed an isolated district practically cut off from the Ohio River and the lake, and would thereby increase the growth and prosperity of the state.

The Miami-Erie Canal was considered a good transportation route for manufactures from the eastern cities to the great river valley at, and below Cincinnati. The Wabash-Erie Canal was expected to control Indiana trade. Toledo, aided by these canals and its position on the lake, was predicted to become one of the greatest gathering points of agricultural production in the country; and it was considered equally favorable for the distribution, over the lakes, of southern products, sugar and tobacco. At that time canals were the most important means of transportation. Their construction required large expenditures, and too great risk, as to profits, for individuals or companies to undertake, hence the canals were to be owned by the state. Ohio, having a relatively dense population and considerable wealth, was able to undertake the construction of canals, and her accessibility to the older centers of settlement was a factor in the prevalent optimism. Ohio capitalists recognized the natural advantages of Toledo as the northern terminus of a canal; other termini were considered, but Toledo was found to be the only practicable one from an engineering point of view. The industrial purposes of a canal in western Ohio would be but partly fulfilled if some other harbor had to be used. Ohioans therefore insisted upon the "proviso" of their constitution.

Thus, when Michigan began to make known her claims to the boundary as specified in the Ordinance, canal building came to a sudden halt. Toledo was the physiographic terminus; the thought of Ohio constructing so expensive a channel of trade and then turning its traffic into a Michigan port was not to be entertained. Michigan was anxious to avail herself of whatever ad-

vantage she might receive from her neighbor's necessity. The boundary question did not assume its really great importance until the northern terminus of the Miami-Erie Canal came up for final decision. The inhabitants of the disputed district had acquiesced in being ruled by the Michigan Territory; however, the boundary line discussion soon led them to take the side of Ohio; the population immediately concerned in the disputed area did not support Michigan.

Population as a Factor.—Northern Ohio did not have a large population in 1830; in the Ohio part of the Maumee drainage basin there were about 11,000. The contiguous part of Michigan contained about 15,500. So far as the ratio of local population is concerned the advantage was with Michigan. In 1840 the population of these same regions of Ohio and Michigan was 56,680 and 75,555 respectively. From these statistics alone we should expect Michigan to have had the greater influence, though we know such was not the case.

The question in dispute was of interest to the entire population of each political division; consequently in this particular the strength of the two political divisions was measured by their relative populations. In 1830 the population of Ohio was 937,903, of Michigan, 31,639; in 1840 Ohio numbered 1,519,467, while Michigan had only 212,267. Capitalists of Ohio, as well as eastern capitalists who were interested in Ohio, had faith in numbers, and accordingly exerted all the political influence possible. Michigan did not have a corresponding population-momentum, a vital geographic influence, though only a corollary of more basal geographic factors. A Michigan delegate to Congress, Mr. A. E. Wing, declared* that a Cincinnati company, interested in the canal, and bodies of eastern capitalists, sent lobbies to Washington to induce Congress to extend the domain of Ohio to the northern boundary. Furthermore, Ohio's population was an influential political body whose good will was essential to the President in the coming election, though this fact, as a basis for the President's action in the case, may have operated only subconsciously.

Conclusion.—These four factors: the position of the southern end of Lake Michigan; the physiography of the Maumee basin and its harbors; the prospective canals; and the momentum of the populations involved, were very important in establishing the boundary line. There were years of Congressional disputes; and politics in its good and bad phases became a feature, but these were only manifestations of the fundamental geographic influences.

*Soule, A. M., *Southern and Western Boundary of Michigan.* Mich. Pol. Sc. Ass., vol. II, No. 2, May, 1896, p. 51.

PETROLEUM

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Origin and Composition

PETROLEUM (*petra,* a rock and *oleum,* oil) consists of a complex group of compounds of hydrogen and carbon, known chemically as the hydrocarbons, and varying greatly in composition, depending upon the variety and proportions of the hydrocarbons present.

Laboratory experiments show that it is possible to produce artificially oils almost indentical with petroleum. These have been produced by inorganic combinations, and also from plant and animal remains. Such experiments seen to throw some light on the probable origin of petroleum.

A few prominent chemists and geologists, even at the present time, believe that these natural oils are of inorganic origin. In proof of this, they refer to laboratory experiments, by which inorganic petroleums have been produced; and also point to the fact that petroleum-like substances are found in lavas, and even in meteorites, where it seems that plant and animal remains could not possibly have existed. Other lines of argument have also been brought forth, which are too long and complicated to cite here.

While it is rather generally admitted that certain small accumulations of petroleum may be of inorganic origin, it is now widely believed that all the greater deposits are organic. Among the evidences cited to show that petroleum results in nature from the partial decomposition of organic matter, are the following:

1. From animal and plant remains, it is possible to separate out, in the laboratory, substances identical with the natural oils.

2. Certain sea-weeds, while decaying, are observed to be covered with an oily coating much like petroleum.

3. From certain shales containing the remains of algae, petroleum can be driven off by heat.

4. Shells of certain types are found to contain small drops of oil believed to result from the decay of the fleshy parts.

5. Petroleum in large quantities occurs far more frequently in sedimentary beds, where plant and animal remains are likely to be buried, than in igneous rocks, where such organic material is lacking.

6. To the above may be added what is now considered by far the most conclusive argument in favor of organic origin. If two artificial petroleums be compared, the one organic, and the other inorganic, they are found to vary widely in their optical properties. The nature of this variation cannot be discussed here, but it is sufficient to say that practically all natural petroleums that have been studied have the properties shown by the artificial oil of *organic origin,* and for that reason are themselves believed to be organic.

Since, under ordinary conditions, with oxygen present, plant and animal tissues completely decay or oxidize, the carbon to carbonic acid gas and the hydrogen to water, it is only when buried and away from the air that the hydrogen and carbon remain together as hydrocarbons to form petroleum. The exact process of the change from tissues to petroleum is not fully understood, but it is suggested that bacteria cause the removal of the nitrogen, that the material is then buried beneath ordinary sediments, and that further changes go on under the influence of pressure and accompanying heat.

There is usually no way to distinguish between oils of plant and animal origin, but it is believed that both plants and animals have their part in petroleum formation.

Accumulation of the Oil

After the burial of plant and animal remains, and their partial decay to form petroleum, the oil still remains scattered in small particles throughout a large mass of rock. Before it becomes available it must collect in "oil pools" or "oil reservoirs." The terms "pool" and "reservoir" are more or less misleading, inasmuch as they are not large cavities in the rock, as the name might imply, but only more porous rock in which the oil may collect, just as water collects in the small open spaces of a sandstone.

To understand how this accumulation of oil into "pools" takes place in nature, we must remember that below the so-called water-table, which usually lies at a comparatively shallow depth, the open pores of the rock are everywhere filled with water, which is in constant but very slow circulation. It must also be remembered that petroleum is lighter than water (sp. gr., 77-98), and that in a mixture of the two, the oil gradually rises and forms a surface layer. We must still further remember that not all rocks are equally porous, and hence not all offer equal facilities for the ready movement of underground circulation.

With these conditions in mind, let us suppose that in some deeply buried bed, partial decay of plant or animal remains is slowly, drop by drop, yielding petroleum which mixes with the water in the surrounding porous rock. Since the oil is lighter, it tends to rise to the surface of the water. Now if overlying this porous rock is one much less porous, the oil will rise and collect on the under side of the less porous layer, much in the same way as steam rises in a room and collects on the under side of the ceiling. If there are arches, or anti-clines, as they are called, in this non-porous ceiling, the oil will rise to the highest points of these anti-clines, and there remain. This is known as the "anti-clinal theory" of accumulation of oil and gas. If there is no water in the pores of the rock, but only air, the oil, because it is *heavier* than the air, will sink to the *lowest point above an underlying* non-porous stratum. While there are many modifications of the above theory, depending on local conditions, they are all based on the same general principles of oil circulation.

Oil Springs and Wells

If, as often happens, the overlying non-porous layer is more or less fractured, some of the oil escapes upward and comes out at the surface with the water, as oil springs or oil seepages. It was these seepages which, in earlier days, led to the search for and discovery of our present large oil fields.

In ancient times, the only supply of oil came from springs or seepages, the oily scum being skimmed from the surface of the water. In early days, oil was secured in this country in the same way, and in oriental lands, the process is still in vogue. Wells or pits are also dug, and the oil skimmed from the water surface. In Japan, such dug wells date back as far as 615 A. D., and are still the rule in that country. They have been sunk as deep as 900 feet, or over, and one well of that depth is reported to have cost not over $1,000. Cheap labor makes such dug wells less expensive than drilled wells, in Japan. In the United States, the "churn drill" is used, a machine of the type used in drilling ordinary deep wells all over the country.

When oil is struck, it is frequently under such pressure that the drill is blown completely out of the hole, high into the air, and the oil spouts forth in a great column, sometimes to a height of several hundred feet, and may flood the surrounding country. Such a spouting well is called a "gusher," and if by accident this column of oil takes fire, it is often very difficult to extinguish. Such burning wells are not at all uncommon. It was the burning of natural oil springs that caused the mysterious "sacred fire" or "eternal fire" of many oriental peoples.

The flow of a well is extremely variable, one well known Russian gusher having spouted 2,000,000 gallons daily. There is always a very rapid decrease in the flow of a gusher; many soon cease to flow, and have to be pumped. The average yield per well of the Appalachian field is now less than 75 gallons per day. When the flow becomes very small, it is common to "shoot" or "torpedo" the well. Powder or nitro-glycerine is exploded in the bottom of the hole, in order to shatter the rock, and render it more open. This usually results in an increased flow.

Pipe Lines

Petroleum was formerly carried to the refineries in barrels or tanks by team, boat, or train. But even early in the industry, pipe lines were established, and now most fields are veritable networks of such lines. The New York pipe line of 6-inch pipe, has a length, including branches, of 750 miles, the main line being 313 miles. It runs over hills 2,400 feet high, and goes under East River, below tide. On this line are 11 pumping stations to pump the oil through the pipes, and the capacity is 28,000 barrels daily.

Refining

Petroleum is sometimes used in the crude form, but for the most part, is first refined. This refining consists in separating the various constituent hydro-

carbons. In detail the process is too complex to describe here, but is based on the simple principle that the various hydrocarbons boil, or vaporize, at different temperatures, and hence the various products can be driven off one by one, as vapor, and then recondensed. Such a process is called distillation. The more common products from the refining of petroleum are kerosene, gasoline, benzine, paraffin, asphalt, and lubricating oils; but there are many others of minor importance.

Chief Uses of Petroleum

Crude petroleum has been much used as fuel. Many railroad locomotives and steamships burn it exclusively. It is also being used largely to spray roads. The chief uses of the petroleum products are for light, heat, power, and lubrication. Certain products are used for medicinal purposes (vasaline, etc.), in varnishes and enamels, for cleaning clothes (benzine) as the base of many chewing gums (paraffin), and for many other purposes.

Below is summarized the world's production of petroleum for 1911, the latest available statistics:

U. S. Production for 1911

	Per cent of U. S. Production
Calif.	36.80
Okla.	25.44
Ill.	14.21
La.	4.86
W. Va.	4.44
Tex.	4.32
Ohio	4.00
Penn.	3.74

World's Production for 1911

United States	63.80 per cent
Russia	19.16 per cent
Mex.	4.07 per cent
Dutch East Indies	3.52 per cent
Roumania	3.21 per cent
Galicia	3.04 per cent
India	1.87 per cent

No other state produces as much as one per cent of our national supply, and no other nation produces as much as half of one per cent of the world's supply.

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THE MULTIPLICATION TABLES OF GEOGRAPHY

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THE subject has been couched in these terms with the intention of suggesting a possible parallelism between the formal work of the lower grades in arithmetic and that which we are to advance as a portion of the lower grade work in geography. The question for consideration, is, then; Is it not possible to turn to geographical account the ability to form in the lower grades lasting impressions through drill? Our belief that it is possible to do this will be expressed in this discussion in a consideration of the advisability of doing this formal work upon place geography in the lower grades. By lower grades, we will be understood to mean as early as the prevailing course of study has rendered the map and its symbols intelligible to the pupil.

Four phases of the question present themselves for consideration: (1) Why make place geography a point for special treatment, or of what worth is an accurate knowledge of place? (2) Why do it as early as possible in the grades? (3) What items of place geography shall be selected and made the basis of drill? (4) What means are useful and advisable in carrying out such drill? These phases will be taken up in order.

(1) An accurate knowledge of place geography has worth, in our opinion, since any training for adjustment in the sense of the ability to enjoy life demands a knowledge of place. It is demanded in order that the press reports may have meaning, which is dependent upon a knowledge of locality, and, to cite another instance, in order that the postmarks upon our mail may satisfy our mental inquiry of "Where from?"

In a more practical way, any training for adjustment in the sense of ability to control environment demands a definite knowledge of place. The choice between a letter and a telegram rests upon the knowledge of the length of time required, because of locality, to transmit the former. It is demanded in determining the route of a shipment, or in considering the advisability of buying at a distance.

Again, the recognition of the relation existing between man and natural resources and between natural resources and physical features, the relational or rational aspect of geography, is of large moment in aiding the appropriate adjustment of the individual to his environment. This recognition hinges upon a knowledge of place. For example, grazing is a fitting industry in the West, holding out inducements and possibilities of adjustments to the grazier, because of the mountains bounding the plain upon the west—these fundamentals being facts of place geography.

It is, perhaps, further indication of the worth of a knowledge of place

to note the large amount of attention which the extended lists of questions for map study in our texts have received and are still receiving—evidence of the belief in the fundamental character of this type of knowledge.

(2) In referring to the proper place in the grades for such drill work it will be helpful to mention a definite grade as the place of beginning. Our own course of study admits it in the fourth grade, and it is fair to presume that this will be typical for a great many schools. There appear to be clearly defined reasons why drill upon facts of place geography can be given here and also in the grade above with great profit.

Memory at this time is both prompt and tenacious. The period of youth from nine to thirteen has been termed the "golden age of memory," due in large part, no doubt, to the acquisition by the individual of the permanent teeth, and the completion of growth of the brain. The mind can now profitably be stored with facts of constant value, and it would seem good economics to do it now, when the return in lasting impressions would be large for the time invested, and when, owing to the delayed arrival of the rational ability, the relational phases of geography could not profitably be taken up.

Drill upon place geography at this time would afford a complete focus of the attention upon the *place* aspect, while, if the acquisition of place be left largely to the time when the location would appear a logical outcome of rational considerations, the focus is upon the relational element, and it is inevitable that the exactitude of place must suffer and give an uncertain nucleus for the associations of later life. In other words, it would seem better to fix the location of Chicago at a time when its exact location would be the all-important consideration than to attempt to fix it in a permanent way at the time when Chicago can be made to appear the only logical outcome of those conditions which have produced it.

Further, a large array of place facts under easy control would render the introduction to rational principles interesting and easy. Boston, Honolulu, Barcelona and Bombay, if fixed by map drill and reviewed in the later descriptive treatment, would furnish the familiar particulars in inducing the "break in transportation" principle? There would constantly appear the old element amid the new which would lend interest as is done when the familiar quotation appears in context or a friend is met in strange surroundings. Continuity is also added by this factor of reappearance of the old amid the new.

Drill, which alone can perfect the imagery upon which a definite knowledge of place geography depends, is not the irksome drudgery to a child in these grades which it becomes with the broadening interests of adolescence. In fact, children seem to find satisfaction in repeatedly doing the thing which has once been successfully accomplished. Repetition is natural, as is evidenced by the child's desire to have a story repeated in its original form, any innovation being unwelcome.

A further reason for giving the drill upon place geography early in the grades appears in the fact that the later consideration of the places drilled upon, in connection with the establishing of relations, furnishes a valuable review and a potent aid to memory through providing the associations which make for frequent recall.

(3) In replying to the question as to which item of place geography shall be selected and made the basis of drill, two principles appear to be suitable for our guidance though they may refer to groups of items which are not mutually exclusive. The first indicates the selection of those items which are useful to the individual in adjusting to his environment (with both enjoyment and practical advantage in mind) and of value in themselves. The second indicates the selection of those items (still with adjustment to and control of environment in mind) which are useful in contributing to the development of meaning or relations. The difference between the principles may be shown by use of the Erzgebirge of Germany. These mountains would scarcely be included because not likely to occur with sufficient frequency in the experience of an American to afford either satisfaction or practical benefit if definitely localized. They are of importance, however, in understanding the industries of an appreciable portion of Germany, in comprehending the adjustment of the German people to their environment, and so, in developing the concept suggested in this connection by "control and response."

These principles would readily be interpreted to mean that less work would be done upon the world as a whole than upon North America, less upon North America as a whole than upon the United States, and less upon the United States than upon the individual's own state. This would be the case because places near at hand are more apt to figure frequently in the individual's experience and so be more intimately related to his enjoyment and his practical adjustments. In general, the list of items in the place geography of any country should include the rivers, mountains, lakes, plains, plateaus, principal cities and water indentations. In order that these general statements may be rendered as definite as possible there are included here typical lists for Germany and Minnesota. For Germany, a list should embrace Hamburg, Bremen, Berlin, Elbe, Rhine, Danube, Bavarian Alps, Erzgebirge, the northern plain, the southern plateau and the boundaries. For Minnesota, if it be the individual's own state, the following: fifty cities (those usually included in the special state editions of our geographies are satisfactory); the counties; the state boundaries; Vermillion and Mesaba Ranges; Minnesota, St. Louis, Red and Mississippi rivers; the three watersheds; Lake Vermillion, Lake Itasca, Leech Lake, Upper and Lower Red Lakes, Lake Minnetonka and Mille Lac.

(4) The manner in which the work shall be done suggests both the distribution of the work in the grades and the manner of treatment from the standpoint of classroom procedure. As to the former of these considera-

tions, it may be done quite independently of the text and the work being pursued in it, but should be so divided between the fourth and fifth grades that the drill contemplated may be completed in these grades. In order, also, to provide the advantage mentioned of the "spiral" treatment, or the reappearance of the particulars drilled upon in later detailed work upon the countries involved, it is well to arrange the drill work to anticipate the course to be pursued. To illustrate, if the work as outlined for the fifth grade includes a study of South America, the drill upon the place geography of South America may properly be arranged for in the fourth grade, while the drill for the fifth grade may be upon those countries yet to be studied, of which Europe is presumably one.

The manner in which the work is to be done as a classroom exercise is dependent in large degree upon the ingenuity of the instructor in planning devices which supply satisfactory motives because of ends quite immediate of realization, and which further the primary object in such drill work, that of perfecting the imagery of the child for the map under study. Map drill of this character may well employ such means as the placing of symbols in outline maps, map drawing, bounding, modeling in sand and even in the more enduring mediums if the number of particulars to be fixed by such an extended piece of work would warrant the investment of time. Much rapid pointing by pupils with the map before the class lends itself to the creation of a game interest and proves a highly practical type of drill which may be often repeated. It is also useful toward the general aim mentioned above to leave the map suspended in sight of the class during the day, as it is undoubtedly true that images may be effectively impressed without conscious effort.

It is the writer's intention to subject the idea as sketched above to experiment as soon as a lapse of time has produced experimental conditions, permitting the comparison of results from pupils subjected to such drill with results from those who have gained a knowledge of place only as the various countries have been studied descriptively and with regard to relations. The soundness of the psychological principle involved is the excuse for presenting the idea before subjecting it to experiment.

HOW OLD IS THE EARTH?

IN a recently published book, *The Age of the Earth*,* Mr. Arthur Holmes (London) reviews the different serious attempts that have been made to answer this question. All of these attempts have one feature in common. The investigators select for their purpose some measurable change which is now taking place on the earth or within it, and endeavor to discover the time

*Harper and Brothers, New York and London, 1913; "Library of Living Thought" series.

rate at which this change is going on, and the total amount of the change since its beginning. Dividing the total amount of change that has taken place since its beginning, by the rate of change (per century, for example), he obtains a result which he considers to be an approximation to the length of time involved in accomplishing the change.

The physicists sought to determine the rate of cooling of the earth, and the total amount of cooling. Their results would represent the period of time since the earth began to solidify. Joly endeavored to determine the total amount of salt in the oceans, and to ascertain the rate at which rivers are carrying salt to them, and thus to obtain an answer to the question, "How long has it taken the rivers to carry this amount of salt to the sea?" He assumed that the oceans have existed since the earth's surface cooled below the temperature of boiling water. Before that the waters could not exist in liquid form upon the surface of the earth, but must have existed as vapor in the atmosphere.

The geologists attempted to ascertain the total thickness of the sedimentary rocks, and the average rate at which such sediments are deposited, and thus to arrive at the length of time since the agents of waste began working upon the lands.

Recently, investigators in the field of radio-activity have attempted a still different method and their findings—whether more or less reliable than the others—have given quite different results.

John Phillips in 1860 concluded that the time required for the deposition of the complete succession of stratified rocks lay between 38 and 96 million years. A year or two later, Thompson published his epoch-making papers on the *Age of the Sun's Heat* and *The Secular Cooling of the Earth.* He pointed out that the sun can not constantly emit heat without becoming cooler, and held, as the result of laborious investigations and computations, that it most probably had not illumined the earth for 100 million years, and almost certainly not for 500 million years. He inclined to the belief that the consolidation of the earth's crust took place about 100 million years ago.

Later, Thompson attacked the problem from the standpoint of the effect of tidal friction upon the earth's rotation and reached the conclusion that the existing state of things on the earth must be limited to some such period as 100 million years. Huxley and others denied the validity of Thompson's conclusions. Later Thompson further narrowed his limits to 50-90 million years, and Tait wrote in 1875 that 10 million years is all the physicists would allow for the age of the earth. In 1893 Thompson, now Lord Kelvin, narrowed his limits to Clarence King's estimate of 24 million years. Thus, the physicists, with the facts then at their disposal, were willing to allow much less time for the cooling of the earth to its present condition, than the geologists considered as absolutely necessary for the accumulation of the sedimentary rocks.

In 1899, Joly, calculating the time required for the accumulation of the salt in the ocean, held that the oceans are something like 100 million years old.

In 1903 came Curie's and Labrode's discoveries that radium maintains a temperature above that of its environment, owing to the spontaneous evolution of heat by its own disintegration. It was found that radium and other radio-active substances are widely distributed in the earth's crust. Then it became evident that through the ages the earth has not been simply losing heat by radiation, but has also been receiving a renewed supply from the disintegration of the radio-active substances within it. The establishment of this fact necessarily vitiated the conclusions reached by Kelvin and the other physicists. Now the estimates of the earth's age are running in the opposite direction, and vastly longer periods of time are being claimed than even the geologists have regarded as absolutely necessary. It is now suggested that the oldest Archean rocks date back 1,600 million years. Quite naturally these figures are looked upon with skepticism. The serious study of the radio-active substances has been pursued for only little more than a decade, and it is not reasonable to expect that the conclusion regarding the age of the earth, reached through such studies, are more nearly final than conclusions reached through the other methods. The interesting point just now is that whereas a few years ago the geologists were insisting upon an older earth than the physicists were able to grant, now the geologists are told that their figures are too small. However discordant may be the conclusions reached by different workers, the very fact that the scientific mind delights in grappling with a problem of such magnitude is a tribute to the dauntless spirit of the scientist. R. H. W.

ELEMENTARY GEOGRAPHY

Rivers of the United States—Twenty Whys

1. Why are there rivers flowing through the land?
2. Why is a stream sometimes clear and at other times muddy?
3. Why do nearly all of the largest rivers flow to the sea?
4. Why is the Mississippi river system larger than any other in the United States?
5. Why are the main branches of the Mississippi longer than the Atlantic slope rivers of the United States?
6. Why are there fewer rivers in the western half of the United States than in the eastern half?
7. Why are there no waterfalls in the lower course of the Mississippi?
8. Why are practically all of the large cities in the interior of the United States found on the banks of rivers or shores of lakes?

9. In a hilly or mountainous region, why do railroads usually follow valleys?
10. Why do more people live in the valleys than on the hills and mountains?
11. Why are streams usually found flowing through valleys?
12. Why do people think that streams make the valleys in which they flow?
13. Why do some streams flow more swiftly than others?
14. Why do streams continue to flow even in dry weather?
15. Why are rivers a help to manufacturing towns and cities?
16. Why do some rivers build deltas at their mouths?
17. Why, or in what way, may a river be injurious as well as beneficial to a city on its bank?
18. Why are the rivers of the United States more useful than those of Canada?
19. Why were our rivers formerly more used for trade and travel than they are now?
20. Why are there no large north-flowing rivers in the United States?

SPEAKING OF THE COMMERCE OF THE UNITED STATES

DID YOU KNOW—

1. That American vessels carry only 11 per cent of our imports and 8 per cent of our exports?
2. That in 1830 American vessels carried 90 per cent of our imports and exports?
3. That despite continuous agitation and lamentation for 30 years, the percentage of our foreign trade carried by American vessels is only 2 per cent above the low water mark?
4. That our most aggressive competitors in foreign markets, Great Britain, Germany and France, are by far the largest buyers of our exports? In a business sense, our chief rivals are our best customers.
5. That 60 per cent of our exports go to Europe, 6 per cent to South America, 5 per cent to Asia, 3 per cent to Oceania and 1 per cent to Africa?
6. That nine times as much (in value) of our foreign trade passes through the port of New York as through Boston, twelve times as much as through Philadelphia, eight times as much as through New Orleans, and eighteen times as much as through San Francisco?
7. That New York is the only one of our four leading Atlantic ports that is at present handling the greatest total of foreign commerce that it ever handled?
8. That New Orleans is our second port in total foreign trade, and Galveston second in the export trade?

9. That Galveston exports 50 times as much in value as it imports?
10. That the Puget Sound ports are growing in foreign trade very much faster than San Francisco? The former have grown from 25 million dollars in 1900 to 103 million in 1912; the latter from 88 million to 110 million in the same time.
11. That Savannah is having a phenomenal growth in exports, having risen from 25 million dollars to over 100 million in the last fifteen years?
12. That our exports from both Buffalo and Detroit exceed those from San Francisco?
13. That we are now the greatest exporting nation?
14. That our exports of the two great staples, wheat and meat, are declining?
15. That agricultural products form approximately one-half of both our exports and imports?
16. That we sell abroad 2-3 of the cotton which we grow, but less than 1-50 of the corn?
17. That food stuffs now constitute less than one-fifth of our exports, while manufactures constitute fully one-half?

WHAT IS A STANDARD SCHOOL GEOGRAPHY?

[The following comments on nine text books of geography, all but one by English authors, appeared in the *School World,* London, in January, 1913. These comments will be of interest to Americans because they reflect the English point of view regarding school geographies. It will be noted that this point of view is substantially like that held by leading American geographers, except that the reviewer believes that questions and exercises ought to constitute a part of any text book in school geography. American authors are not unanimous on this point. We believe, however, that there is a demand among teachers for questions and exercises in our text books. We believe with the English reviewer, that they are desirable and ought to be favored.—*Editor.*]

(1) *The World.* Anon. Our Own and Other Land Series. 380 pp., maps and illustrations. (McDougall's Educational Co., Ltd.) 2s.

(2) *Europe.* By J. F. and A. H. Chamberlain. The Continents and their People. 258 pp., maps and illustrations. (New York: The Macmillan Co.) 3s.

(3) *Man and his Conquest of Nature.* By Marion I. Newbigin. vi+183 pp., maps and illustrations. (Black.) 2s.

(4) *A Class-book of Physical Geography.* By A. T. Simmons and E. Stenhouse. viii+436 pp., maps and illustrations. (Macmillan.) 4s. 6d.

(5) *The Sea Road to the East.* By A. J. Sargent. 124 pp., maps and illustrations. (Philip.) 1s.

(6) *The Marlborough Country.* Notes on Sheet 266 of the one-inch Ordinance Survey Map. By H. C. Brentnall and C. C. Carter. 171 pp., maps and illustrations. (Clarendon Press.) 2s. 6d.

(7) and (8) *The Elementary Geography.* Vol. v., North America, and Vol. vi., *The Three Southern Continents.* By F. D. Herbertson. 152 pp. and 186 pp., maps and illustrations. (Clarendon Press.) 1s. 6d. and 1s. 9d.

(9) *A First Book of General Geography.* By B. C. Wallis. Maps and illustrations. (Macmillan.) 1s. 6d.

There are certain standards which a school geography should observe if it is to find favour in the schools of to-day. To begin with, it must be accurate and up-to-date. It must lay great stress on cause and consequence, especially from the point of view of man and his environment, emphasizing at the same time the correlation between geography and history. Its style should be interesting, but avoid what one may call the reader-pure-and-simple type. To satisfy alike the energetic teacher and the watchful inspector, it should contain exercises for practical work and for cultivating powers of observation. Moreover, it should show pictures which really illustrate its text, and simple sketch-maps which elucidate its teaching.

And while this is the positive side of the ideal school geography, there is a negative side of the ideal school geography, which is quite as important. It must not be too expensive, and it must not be too long. It must avoid prolixity, or it will obscure essentials, which is the commonest fault (or misfortune?) of the really interested teacher himself. It must, on the other hand, beware cataloguing, or it will encourage economic rather than rationalistic teaching.

How far this ideal standard is attained by the nine books listed above depends in the end upon the man, or woman, who uses them. Certainly there is not much to carp at in any or all of them, though not one singly—like the individual teacher—is perfect. This makes a great feature of one point, that, of another; it is for the teacher to provide the requisite supplement. Presuming, then, that these new geographies are all satisfactory—more or less—and up to the twentieth century standard of school geographies, it only remains to indicate the special features of each.

McDougall's *World* (1)—adapted for, say, the middle school—divides the world into the usual continental headings, subdividing each continent into combined physical and political areas thus: "The Build of Asia." "The Rivers of Asia," "Where the Turk Rules," "The Holy Land," "Iran," and so on. The book is of the "reader type," and therefore rather sketchy

from the teacher's point of view. The pictures—and there are many—are excellently presented, and the colored maps are simple and speaking. The black-and-white sketch maps are not so satisfactory. Many of them are not needed in face of the numerous good and cheap atlases now published, some are scaleless, and others perpetuate the unconvincing system which represents highlands by snakes and caterpillars. The correlation of history and geography is continually emphasized, and there is much interesting matter. We have never read a better short account of the Panama Canal. Two defects are notable: there are no exercises, and there is no index.

The Chamberlain *Europe* (2) is an elementary regional geography, written from an American point of view, in American "English" and American "spelling." It may be described as a sort of chatty guide for children rather than a geography. There are no exercises.

Man and his Conquest of Nature (3) is almost a commercial, or rather an applied ,geography, and is adapted to such sixth form or matriculation boys as take more than the ordinary interest in the subject. Its title sufficiently explains its scope and object. It is essentially a human geography, and it rightly boasts of its "humanity." "It is no part of the work of Geography," writes the author, "to lay down rules as to the best solutions of particular problems of land utilsation, but it is her work to set forth as clearly as may be the conditions which reign at different parts of the earth's surface, for a consideration of these furnishes the raw material upon which all political and social judgments must be based." The idea underlying this statement is far removed from that old view which considered the whole use of geography was to tell us where places are. Causes and consequences naturally are strongly emphasized in every chapter. If pictures were needed for a book of this type, we think that more care should have been expended over their production, and we should have liked to see here and there a set of exercises, or even questions, on its subject-matter.

Simmons and Stenhouse's *Physical Geography* (4) is essentially a "practical" work of the type familiarized in the books of Simmons and Richardson, Wallis, Davies, &c. It, too, strongly strikes the human note, and is to be commended therefor. Its great feature is the prominence given to exercises and questions throughout its three sections, Maps and Astronomical Geography, Land and Sea, and Climate.

Sargent's *Sea Road* (5) consists of six lectures describing the ordinary sea route from Gibraltar to Wei-hai-wei, and is written round—so to speak —the set of lantern-slides carefully prepared under the supervision of the Visual Instruction Committee of the Colonial Office. This means an outlay of 20 to 30 pounds if the whole 370 slides be purchased, a few only of which are introduced into the body of the book. The slide numbers are indicated in the margin of the text.

The Marlborough Country (6) is an example of excellent local work in

geography. It is not necessarily a teacher's book at all, nor is it adapted for any special examination, though it may be used for both purposes. It is just the sort of book an ordinary man, who is interested in things geographical and is staying in the Marlborough country, would buy and enjoy in conjunction with the indispensable ordinance map of the district. Attention is directed to the why and the wherefore of those things which a guide-book simply notes as worth seeing, to wit: water meadows, lynchets, sarsen stones, white horses, dewponds; to the geographical "controls" which have placed Marlborough and Calne (the only two boroughs in the map) where they are; and to the history and geography combined in place names, such as St. Anne's and Walker's Hills. There are a number of capital sketch maps and illustrations, and many exercises and questions.

Mrs. Herbertson's *Elementary Geographies,* (7) and (8), are the last two of the Continental volumes in the series of Oxford geographies edited by Dr. Herbertson. The names of author and editor are at once a passport to success and a guarantee of efficiency. The standard of work is slightly in advance of the preceding volumes, but nowhere is it too difficult for its young students. Environment and its influence on man is the principal theme; plant geography, for example, is nothing but applied climate. All is worked in simple style from the strikingly coloured maps on the inside covers to the illustrative pictures and their explanatory notes. There are plenty of exercises.

Wallis's *First Book* (9) is one of a series of "First Books of Science." As such it contains much introductory matter provocative of ideas and suggestive of outlook. The first three chapters are on maps, the next seven on the regions of the world arranged according to physical conditions, and the last seven on the continents politically considered. There are many exercises and many maps.

A CORRECTION

Mr. J. A. Dresser desires to correct an historical statement made in his article on the "Clay Belt of Northern Ontario and Quebec," which appeared in the April issue of this Journal. The first systematic exploration to ascertain the limits of this great agricultural district in Ontario, which was made in 1900, was done under the auspices of the Department of Crown Lands of Ontario and not by the Bureau of Mines, as was inadvertently stated in the article in question. This correction is due to the Department of Lands and its officials, and especially to the Deputy Minister, Mr. Aubrey White, to whose far-sighted direction much of the development of this district should be credited.

NOTES

A Cheap and Convenient Re-enforcement for Topographic Maps

WHEN, new, clean, topographic maps cost but three cents each it did not pay to spend much effort in the care of laboratory copies. However, with the spread of "the increased cost of living" to include even government maps, as evinced by their recent doubling in price, methods which before scarcely would have paid, now become well worth while.

A convenient method of re-enforcement has been tried out on the laboratory copies of the maps and folios at the University of South Dakota. It has worked so well that I have no hesitation in recommending it. The method consists in pasting a strip of Kafft gummed tape on their backs as near the margin as convenient. This 1 1-4 inch tape interferes in no way with the usefulness of the map, and very greatly decreases tearing or fraying. The life of our maps has been at least doubled by its presence.

This gummed tape costs but 50c per roll of 800 feet, or in other words one-third of a cent per map. Timed tests prove that all the operations required to re-enforce a map (measurement and cutting off the right lengths of tape, its moistening by being drawn over a sponge set in a cup of water, and its application) can easily be done within two minutes. Considering 20c an hour as reasonable wages for such work, a map can be re-enforced at a cost of one cent. Assuming conservatively that its life is doubled thereby, the net returns are 500 per cent on the investment. In these hard times what teacher or institution can let such an opportunity pass!

Cloth gummed tape, we have found but slightly better than the Kafft paper tape. It is half again tougher, but the Kafft tape seems to be sufficiently strong. Since the cloth tape costs a cent a yard or about 2c a map the margin of profit is much less. Though after being under pressure over night the Kafft re-enforced maps show not the slightest tendency to curl, the cloth taped maps do not curl even if not subject to pressure while drying.

I have found that the broad blank margins of the topographic maps can be trimmed off in less than a minute and that a decided increase in the handiness and strength results at a very slight increase in cost.

The gummed tape or cloth tape can be obtained from any paper house. We got ours from the Standard Paper Company, of Milwaukee.—(S. S. Visher in *School Science and Mathematics.*)

A NEW INDUSTRIAL NATION

One of the most remarkable results of the modern utilization of electric power is the changing of Norway into an industrial nation. This far northern country, with a rugged and difficult topography and a niggardly soil, had bred a bold and resourceful and patient people, who have held

their own in the world largely by their daring and skill as seamen. They had looked forward to small part in the new era of worldwide industrial development save as carriers of commerce that more richly favored peoples originated.

Then came Dr. Samuel Eyde, a Norwegian who had studied his profession of electro-chemistry in Germany (and who was co-inventor of the process by which nitrogen is precipitated from the air by the use of high-powdered electric currents). Backed by French capital, in July, 1903, Dr. Eyde established a small factory at Frognerkilen and employed two laborers and two other men to handle the product of a 25 horse-power furnace. In less than ten years two plants have grown from this beginning: one at Rjukan and one at Notodden. They use 200,000 horse-power and require 1,340 laborers and 143 other employees to handle their product which is now 100,000 tons a year. This capacity will soon be doubled by extensions now under way. Where less than 600 people lived ten years ago, now more than 10,000 have their homes in the two towns.

The nitrogen obtained from these plants not only creates a great industry in commercial fertilizer, but it will form the basis of other industries that depend upon nitrogen and its by-products (such as the manufacture of guncotton, dynamite and of nitrate of ammonia, which is the principal ingredient of many of the explosives that are used for submarine mines. Some of these industries have already been founded in Norway.)

And these things are only a small utilization of the industrial possibilities of Norway. Though that country has no raw materials, it has vast resources of accessible electric power for manufacturing plants. Thirty million horsepower now run to waste and other millions can easily be added to these possibilities by dams that can be built to store more power. Dr. Eyde has pointed the way for a commercial regeneration of Norway that may make it a rival of the greatest manufacturing nations. The history of England's ships and England's coal may be repeated in Norway's ships and Norway's electric power.

An apparently little discovery and the chief leadership of one man may thus change the whole character of a people's industries and their relative place in the world and their history.—[The World's Work.]

The Beet-Sugar Industry

The average American consumes 82 pounds of sugar each year—and only ten pounds of that ration is now produced in this country. Sugar is a product of manufacture mainly from sugar cane and sugar beets. Incidentally some sugar is produced from the sap of the sugar maple—the entire value of that product, both sugar and sirup, and the sorghum sirup, being only about $15,000,000 annually, while the total value of the sugar beet and sugar cane industries of this country total about $120,000,000.

Beet sugar is a comparatively recent product of this country, and can scarcely be said to have existed 20 years ago. The production during the 12th census year (1899) amounted to 81,729 short tons, while the 1912 product aggregated 700,000 short tons valued at $73,000,000.

There are now in operation 66 factories in 17 states, which used during the past season 5,062,333 tons of beets produced on 473,877 acres. Yet this industry produces practically only one-eighth of the home consumption. The importation from entirely foreign territory now approximates 2,000,000 short tons annually. A home beet sugar production sufficient to cut off this production would not effect the home cane sugar industry adversely, because that has so nearly reached its limit that any possible growth it may have from now on will not equal the annual increase in the country's consumption, which has considerably more than doubled in the past 25 years, and now is greater per capita than any other country except England.

With our present low average of 1 1-4 short tons of beet sugar per acre, it would require 1,600,000 acres to produce the 2,000,000 short tons now imported; or, as the acreage harvested the last year was slightly less than 475,000, it would need the production of 2,000,000 acres under beets to equal the entire home demand, a condition to which for more than 80 years economists have looked forward.

In the 19 states adapted to growing beets there are about 2 1-2 million farms, and 278,719,622 acres of improved land. Therefore if every farmer in those states could cultivate 1 acre of sugar beets, some of the cane sugar from noncontiguous territory would have to seek another market. Or if one farmer in four in these states would plant a 3-acre patch and give it the care that could readily be bestowed upon so small a plot, it would be unnecessary for us to buy foreign sugar. Two-thirds of one per cent of the improved land in the states adapted to sugar beets would accomplish this result, and more than that acreage lies idle, absolutely unused, every year. Any one of the states of Illinois, Iowa, Kansas, Missouri, Minnesota, Nebraska, or Ohio could produce all this sugar and then have the beets come only once in a ten-year rotation; and several of the others could do it alone on a 5-year rotation. The devotion of the necessary 2,000,000 acres to the production of the sugar required for our own consumption would have an utterly insignificant effect in reducing the acreage of other crops, and in fact, the growing of the beets would actually increase the total yields of other crops, because of the effect of the beets upon the soil, for the thorough working of the soil necessary to grow a profitable beet crop increases the yield of everything else grown on the same ground in succeeding years, and the beets ned occupy the soil but one year out of ten.—[*Bulletin U. S. Dept. Agr., Dec.* 1912.]

Railroads as the Promoters of Farming

For a generation or more the railroads of this country have been making

efforts to increase the number of farmers in certain regions, thus trying to promote agriculture and through greater agricultural prosperity, to increase their revenues derived from hauling farm products. Within the past decade these efforts to encourage agriculture have been extended to include instructions in methods of farming, investigation of the farming possibilities of a region, assistance in organizing agricultural associations, co-operation with state and county fairs, employment of farm labor, aid in finding markets, and other helpful lines of work. These projects are not confined to railroad companies; they are, however, the most prominent of the several classes of business concerns engaged in similar work.

Therefore the summary of recent developments in the agricultural promotion work of railroads in a recent bulletin of the Bureau of Statistics of the Department of Agriculture, entitled "Railroads and Farming" is of interest. This publication reviews briefly some historical features of the subject, giving instances of efforts made for the settlement of farm lands in Kansas, Texas, and Louisiana, during the two decades from 1870 to 1890. The principal features of present-day promotion work are described and an analytical outline shows these features in detail.

More than three-fourths of the railroad mileage of the United States is operated by companies which engage in special efforts to promote agriculture. A list of these companies is given at the end of the bulletin. These railroads enter counties whose total area is almost nine-tenths of the total land area of the United States and whose farms compose more than nine-tenths of the farm area in the entire country.—[*Bulletin U. S. Dept. Agr.*]

Oases of the Sahara

The so-called oasis of Tifillet, south of the Atlas Mountains, is not a single oasis, but is made up of a number of separate oases, with some 300 walled and fortified villages. The Tuat oasis is in a central position between the northern marts and Timbuktu, and is an important meeting and trading center. It is in the basin of the Wad Saura, and is composed of some 300 or 400 petty states, extending over an area 200 by 180 miles. The Kewar oasis is the most important to the traveler on the route from Tripoli to Lake Chad. It lies in a depression about 50 miles long, and is said to be one of the hottest districts in the world, but the underground reservoir yields abundant water for the date groves and for passing caravans.

The oases of the Jerid are perhaps the most accessible, and the best known of the date gardens of the Northern Sahara. There are some 6000 acres in each oasis, with nearly one million date trees all told. Each oasis is a dense forest, with many individual holdings. The gardens occupy a gentle slope at the base of an escarpment which forms the northern border of the desert. South of the slope lies a broad, shallow pond, encrusted with salt, one of the

chain of depressions stretching west from the Gulf of Gabes. From the base of the bluff, or escarpment, there gush forth numerous springs which furnish the oases with a constant and abundant supply of water for irrigation.

Always along the sandy beds of the old river courses, water may be found. The water which falls as rain in the highlands, after following the wadies for short distances very quickly disappears in the sand and gravel and follows underground courses. There seems to be an almost inexhaustable supply from these underground reservoirs. Not only along the river courses, but throughout the sand-dune areas and in the plateaus, water may be obtained by digging or boring for it. In some places the underground water is so near the surface that the roots of the palm trees reach down to it, and in other places the palm trees are set out in the sand and the water from wells is taken to them. The methods of irrigation are very primitive. But since the French occupation of the Algerian Sahara, thousands of artesian wells have been located by the French engineers, and better methods of irrigation are being introduced.

The land in the oasis is held in common by the people in a village. A man does not own the land upon which his trees grow or in which his well is dug, but his riches are counted by the number of trees he owns and the number of wells he controls, as among the nomadic tribes a man's wealth is measured by the number of his camels.—[Marion Weller, *"The Great Sahara," Bulletin Northern Ill. Normal School,* May, 1912.]

The Colorado, the Nile, and the Susquehanna

The Colorado River, which drains an area of some 300,000 square miles, is often called the Nile of America, and like the Nile it is subject to an annual summer rise which comes at the time the water is most needed for irrigation. In Water Supply Paper 289 of the United States Geological Survey, an interesting comparison is made of this great southwestern river with the Egyptian Nile and with the Susquehanna. The Nile is similar in type to the Colorado, the Susquehanna shows the difference in flow between arid and humid regions. In the comparison a normal year, based on a 10-year record for Colorado and Susquehanna rivers and such data as could be found in regard to the Nile, have been used. The Colorado has been taken as the standard of comparison.

The Nile has 5.7 times the drainage area, and the Susquehanna about one-eighth the area of the Colorado. The rainfall in the Nile basin is 3.8 times greater; that in the Susquehanna basin is 4.5 times greater. The run-off per square mile from the Nile basin is 1.9 times greater; that from the Susquehanna basin is 37 times greater. The discharge of the Nile is 10.8 times

greater than that of the Colorado; that of the Susquehanna is 4.5 times greater.

The annual maximum flow of the Colorado varies from 50,000 to 150,000 second-feet and occurs in May, June, or July; for the Nile it is about 353,000 second-feet and occurs about the first of September; for the Susquehanna it is from 150,000 to 550,000 second-feet and occurs during March, April, or May.

The annual minimum flow of the Colorado varies from 2,500 to 5,000 second-feet and occurs during January or February; that of the Nile is about 14,500 second-feet and occurs about the end of May; for the Susquehanna it is from 2,200 to 11,000 second-feet and occurs in September or October.

The mean flow of the Colorado for the period 1894 to 1903 was 10.700 second-feet. The mean flow for the period 1904 to 1910, however, was 25,400 second-feet; for the Nile it is about 115,800 second-feet; for the Susquehanna it is about 41,000 second-feet.

A copy of the report may be obtained free on application to the Director of the Geological Survey, Washington, D. C.—[*Bulletin U. S. Geol. Survey.*]

SUGGESTIONS FOR A STUDY OF THE FOREST RESOURCES AND INDUSTRIES OF THE UNITED STATES

1. Originally about one-half of the area of the present United States was forest covered. Where was the unforested portion? Why there?
2. One-half of these forests have already been cut off. Give two reasons for their rapid removal.
3. There are five principal forest belts: (a) *Northern belt,* from Maine to Minnesota and extending south along the Appalachians. White pine was the most valuable timber of this belt; 70 per cent of this timber has already been cut. Why such a high percentage?

   (b) *Southern belt,* on the Coastal Plain from New Jersey to Texas. Yellow pine predominates; 50 per cent now cut off. At present our leading source of timber (Louisiana first). Why was the white pine used first? This belt is our chief source of naval stores valued at $25,000,000 a year. What are naval stores? How obtained? For what used? Florida is now the leading producer of naval stores.

   (c) *Central hardwood belt;* 80 per cent of the timber now removed; highest proportion of any belt. Reasons? What are the most useful hardwoods? For what used? Why less used than pine?

   (d) *Rocky Mountain belt;* scattered patches. Largely western pine; 75 per cent still left. Why so much?

   (e) *Pacific belt;* heaviest near coast; nearly all soft wood. Douglas fir predominates; splendid forests; 80 per cent still left. Leading lumber

producing state of the Union is Washington. Oregon has more forests than Washington, but produces less lumber. Reasons?

4. We take 250 cu. ft. of wood per capita from our forests yearly; Germany, 37 cu. ft., and France 25 cu. ft. Account for the difference.
5. Eight woods constitute 83 per cent of our product; yellow pine (16 1-4 billion ft. b. m.); Douglas fir (4.8); oak (4.4); white pine (4); hemlock (3).
6. Lumber production is widely scattered; 19 states produce (each) a billion board feet or more a year.
7. The annual value of our forest products at the place of production is about 1 1-4 billion dollars; costs the consumer several times as much. This is 15 per cent of the value of our farm products, and 60 per cent of the value of our mineral products. Make a list of the large uses to which wood is put. Three-fourths of the timber cut is soft wood. Explain why.
8. Our great forest reserves are in the Gulf States and the Pacific States. Explain why.
9. Forty years ago three-fourths of our timber lands were owned by the nation or states. Now four-fifths are privately owned. Three companies hold 238 billion feet, or 11 per cent of all the privately owned timber; five other companies hold 15 per cent more; 200 holders have one-half the total. The Southern Pacific Railway owns 4,318,000 acres in Oregon and northern California.
10. How have private companies gained such enormous holdings? Discuss the wisdom of the public policy which permitted this? What are the gains and losses to the public?
11. From 1875 to 1900 the Great Lakes region (especially Michigan and Wisconsin) was the heaviest producer of lumber. Reasons?
12. Five great industries depending upon forest products are (1) the production of building materials, (b) pulp and paper, (c) furniture, (d) tanning extracts, (e) naval stores. Where are the main centers of production of each?
13. The waste of wood is enormous. Point out chief causes of waste and loss.
14. Give main reasons for a policy of conservation of forests. What is sane conservation? Why does anybody oppose conservation?
15. Forest products originate more than 100 million tons of railway traffic yearly, second only to mineral products.
16. Name 8 to 10 kinds of wood which are particularly well suited to specific uses, e. g. for paper-pulp, cross-ties, furniture.
17. Paper and pulp are mostly made in the northern forest belt: Give three reasons. Where are some of the greatest paper-making centers?
18. Why have the pine lands been less quickly reduced to farms than the hard wood lands?

RECENT PUBLICATIONS

METEOROLOGY. A Text-Book on the Weather, the Causes of its Changes, and Weather Forecasting, for the Student and General Reader. By Willis Isbister Milham. XVI and 549 pp. Maps, ills., index. The Macmillan Co., New York, 1912. $4.50. 9x6.

Teachers who have had the use of Professor W. M. Davis's "Elementary Meteorology" have realized the increasing need, during the past few years, of a newer text, which should present the latest developments of the science. Professor's Davis's book, which for effective and logical presentation of the subject cannot be surpassed, is already some fifteen years old. While, doubtless, some teachers have found the volume rather difficult to master, no one who has compared it carefully with other more recent books can have failed to see how important a contribution Professor Davis gave us when he wrote it, and how widely it has been made use of by later writers.

In the latest meteorological text-book, by Professor W. I. Milham, of Williams College, we have just what teachers of geography in general, and teachers of meteorology in particular, have been looking for. It is an up-to-date presentation of the present status of the science, with very full (almost too full) bibliographies, carefully arranged by subjects; with marginal headings, chapter summaries, questions and topics for investigation. One of the greatest lacks of Professor Davis's "Elementary Meteorology" was the absence of bibliographies, and of illustrative weather maps. In both of these respects Professor Milham's new book is more valuable. There are also many more illustrations. One mistake which, it seems to us, Professor Milham has made is in overloading his text. In his natural desire to have the discussion very full, he has, perhaps, gone too far in presenting *numerous* theories and explanations in some cases, to the confusion rather than to the enlightenment of his readers. However, the advantage of such a treatment is that few persons who use Professor Milham's book will probably need to seek further information elsewhere. It is a pity that the volume is so expensive, for it ought to be found among our school reference books everywhere. We cordially recommend it to those who want the latest good text-book on meteorology in English. R. DEC. WARD.

WEATHER SCIENCE. By R. G. K. Lempfert. Small 8 vo. Pp. 94. Figs. 16 "The Peoples' Book." (London, T. C., and E. C. Jack (n. d.).

Within less than 100 small pages, Mr. Lempfert, who is Superintendent of the Forecast Division of the Meteorological Office in London, has given a remarkably clear and concise view of the elements of meteorology. It would be difficult to suggest any improvements possible within the limits of space assigned to the author for his treatment of this large subject. Mr. Lempfert

is singularly successful in his summaries of the present state of our knowledge of many debated points. His two short pages on the stratosphere, and his statement that "observations on the upper air have not yet thrown much light on the all-important question of the ultimate causes which give rise to cyclones and anticyclones, though they have added much to our knowledge of the conditions prevailing in them when formed," are good illustrations of this point. A reader who gains his first acquaintance with meteorology through this little volume is pretty sure to want further information on the subject. And it is, after all, the chief value of such brief elementary books as this, that they stimulate further study. R. DEC. WARD.

THE DUAB OF TURKESTAN. By W. Rickmer Rickmers. Cambridge University Press and University of Chicago Press, 1913. 7 1-2 x 10 1-2 inches. XV+563 pp. Royal 8 Vo. $9.00; postpaid $9.44.

The book deals with that portion of Russian Turkestan lying between the Oxus and the Jaxartes rivers and including the two cities of Bokhara and Samarkand and a portion of the Pamirs. The author calls it a physiographic sketch and an account of some travels. There are 207 maps, diagrams and photographs. The half-tones are excellent, some of them are remarkable. Only in the perfectly clear atmosphere of the arid lands could such photographs be secured. The sketch maps and diagrams are very effective, unusually so. The author is modest and his narrative is not lumbered up with inane details such as travelers too often impose upon readers of their books.

This is said from the geographic standpoint, for the book contains many details of a physiographic and climatic nature which add to its interest to geographers but not to the general public.

The author's delicate touches of humor, his picturesque language in description, his knowledge of physiography and climatology, and his familiarity with the literature of his subject, all contribute materially to the excellence of the book. The descriptions of the people—nomads, city dwellers of Bokhara and Samarkand, native officials, and mountain tribes—are interesting reading and bespeak the keen observer and experienced traveler. Much attention is given to physiographic processes and features, but the splendid half tones tell the story better than words. The record of the peculiar action of the weathering agents and of the glaciers is a distinct contribution to physiographic science.

In the appendix, the author enters into a discussion of a number of unsettled questions, such as, the number of glacial epochs represented by the morainic deposits in the Pamirs, the value of the evidences of supposed climatic changes in Turkestan in historic times, and the relation of forests to rainfall, but reaches no very definite conclusions.